Lau Gatignon / CERN for MDI team

MDI Common Paths

Introduction

MDI is very different between ILC and CLIC:

- Organization wise (ILC in experiments, CLIC on machine side)
- QDo technology (ILC cold, CLIC warm)
- Time structure of beam arrival
- IP feedback (ILC digital, CLIC analog)

Still worth looking for synergies:

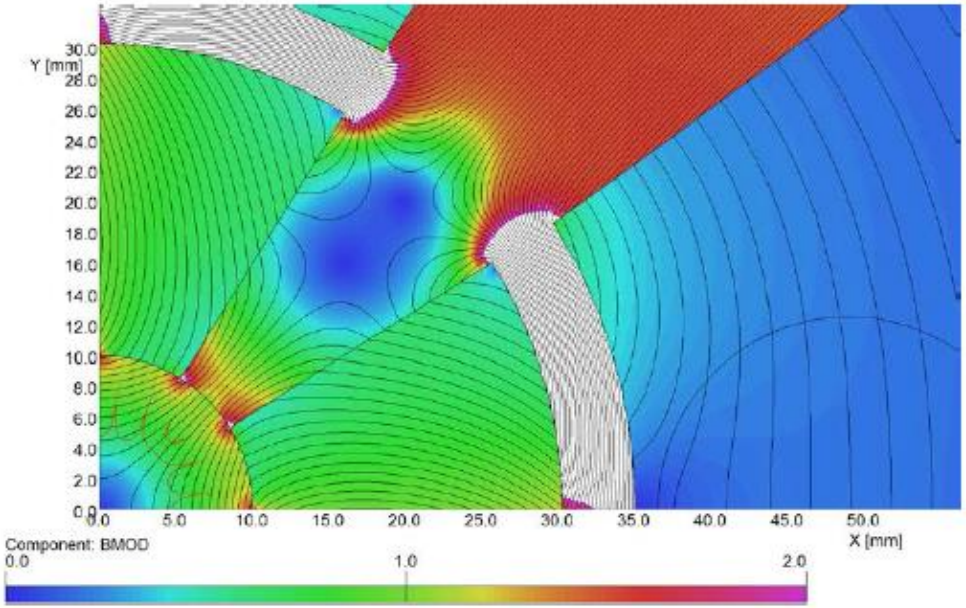
- Can hybrid QDo technology be applied to ILC? Consequences?
- Spent beam design could be more similar
- Muon sweeping in BDS (BDS or MDI?)
- Others?

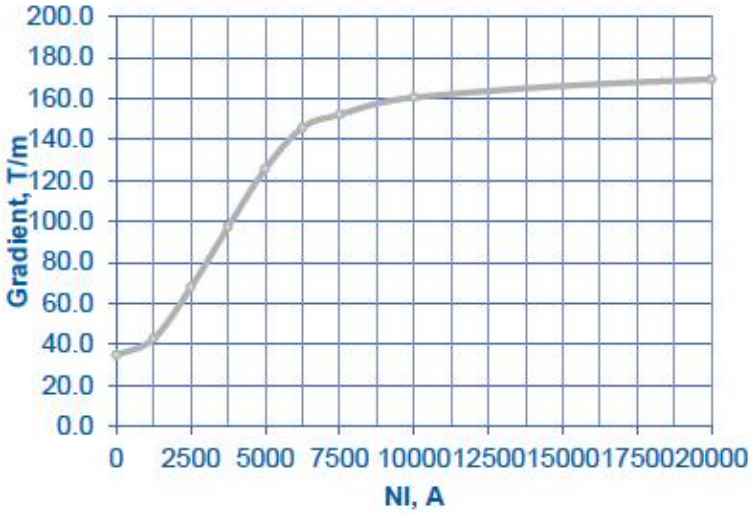
Hybrid QDo

- CLIC went for hybrid, warm technology.
  Choice mainly driven by stabilization requirements.
- This choice impacts on many aspects in MDI:
  - QDo design itself
  - Anti-solenoid is imperative for PM protection
  - No cryo-pumping 'for free'
  - Integration issues
  - .....
- L* not yet definitively clarified. Impact on integration issues.

- Michele Modena has had a first look at QDo adaptation to ILC.
- Many related aspects go well beyond QDo itself and involve MDI.
- Hybrid technology could also be an option at ATF2

We have tried to "scale" our CLIC QD0 design taking into account the ILC layout and geometric conditions but also starting an optimization of the main parameter toward a wider field quality range for the demanded tunability.





"red line" inside the aperture: area where ΔG/G ≤1 unit (good field region)

NI	A	0	1250	2500	3750	5000	6250	7500	10000	20000	40000
Gradient	**T/m**	**34.7**	**42.8**	**67.8**	**97.3**	**125.7**	**145.8**	**152.2**	**160.6**	**169.4**	**174.9**
b6	**units**	61.2472	45.2059	19.9428	6.8605	-0.0183	-3.3895	-4.2944	-5.3982	-6.4427	-7.0075
b10		0.1978	0.1510	0.0769	0.0386	0.0215	0.0173	0.0173	0.0182	0.0201	0.0217
b14		0.000192	4.51E-04	8.62E-04	1.07E-03	1.16E-03	1.16E-03	0.001148	0.001123	0.001086	0.001056
b18		0.003501	2.58E-03	1.14E-03	3.89E-04	-4.59E-06	-1.98E-04	-0.00025	-0.00031	-0.00037	-0.0004

Main multipoles estimated at r = 3 mm; 5000 NI is the nominal working point (125 T/m)

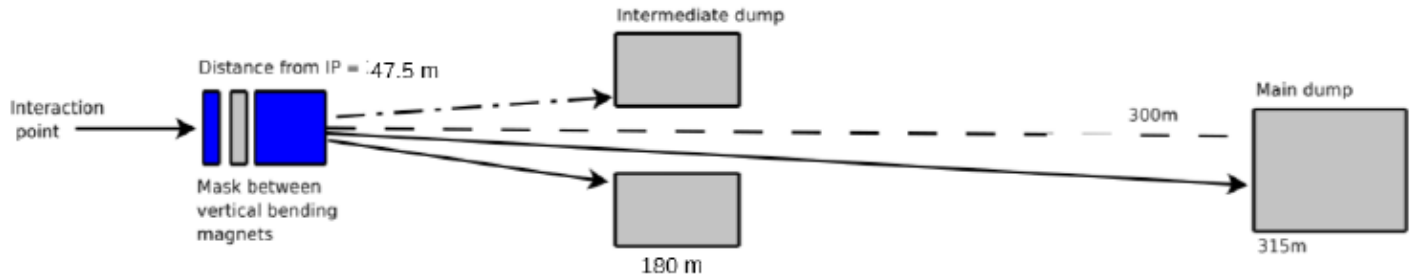
(Computation: courtesy A. Aloev)

Spent Beam

- Both in ILC and CLIC the spent beam must be transported away cleanly through the experiment onto the beam dumps.
- On the CLIC side a new design has been presented at the Hamburg workshop by Lawrence Deacon, who now left CERN. This new design has many advantages w.r.t. the old one:
  - Magnet lifetime
  - Power consumption
  - Cost

  It may be considered whether a similar design could be applied to ILC.

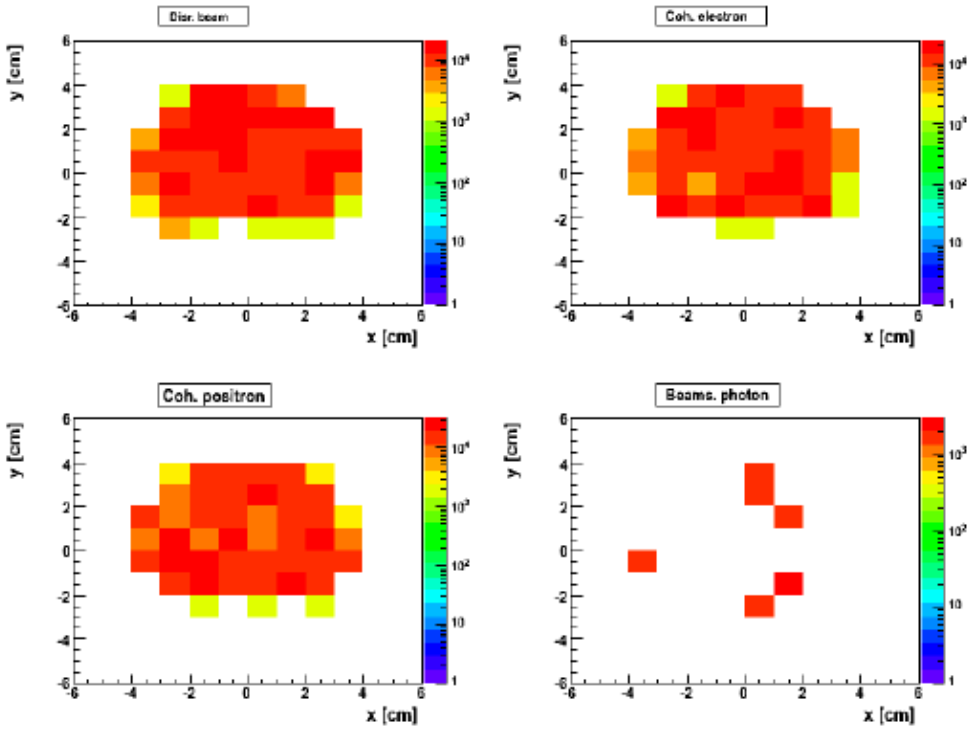
New layout



- We need to consider the back scatter to the detector – photons, electrons, neutrons scattered back to detector from intermediate dump
- Assuming time window of 150ns (bunch train) + ~100ns (detector integration time) particles scattered back from <40m could cause background to the detector
- So better to have magnet at 47.5m than 27.5m (old CDR design)

Back scatter to detector – new post collision line – preliminary results

- Right: back scattered photons per m^2 at the detector
- By beam type
- $\sim 10^4$ per m^2 (fewer than in CDR version)



Muon Sweeping

- In ILC the muon sweeping is based on dipole magnets.
  - Need precise machining
  - Bulky
  - Costly
  - Effect on main beam to be compensated (hence radiation)
- For CLIC we propose toroidal fields
  - Zero field on the beam
  - Therefore weaker requirements on engineering precision
  - Less bulky, do not obstruct the tunnel
  - Cheaper
- Maybe a combination of the two can be considered
  - Initial sweeping with dipoles (both polarities present)
  - Then toroids

Conclusion and Outlook

- There are some fields of synergy
  We propose to follow these up in our MDI meetings with input from ILC colleagues.